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RESPONSE TO THINNING 60-YEAR-OLD DOUGLAS-FIR

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Thirty years of growth after the first thinning in a 60-year-old Douglas-fir stand on site IV show that heavy thinning substantially depressed gross increment in ensuing years. However, a moderate thinning reduced gross increment only slightly. Growth was well above normal on both moderately thinned and unthinned stands, but was a little less than normal on heavily thinned areas. Records single out the increased increment obtainable on actual stands as compared with normal yield table estimates. Main advantages in the thinnings were: (1) salvage of mortality; (2) reallocation of stand growth potential to fewer, larger, and higher quality trees; and (3) realization of earlier returns through thinning. Presumably, the stand was too old for heavy thinning to speed up residual tree growth sufficiently to compensate for loss of increment on trees cut.

Four of six areas, located at the base of Mount Walker, Olympic National Forest, near Quilcene, Wash., were thinned in 1934 and 1937.[1/] Basal areas removed were 31 and 37 percent on moderately thinned plots 9 and 10; 44 and 50 percent on heavily thinned plots 6 and 7 (figs. 1 and 2). Thinning, chiefly from below, removed mostly suppressed and intermediate trees, but also included some dominants and codominants to eliminate "wolf" trees and improve spacing. Plots 5 and 8 were left untouched as checks. A second light thinning in 1949 and a third in 1958, on three plots, improved spacing, removed poorer grade trees of lower crown class, and salvaged dead or dying trees. The original stand on plot 7 was 20 percent less in basal area and cubic volume than an average for the five other plots.

1/ Worthington, Norman P., and Isaac, Leo A. Experimental thinnings in young Douglas-fir. Northwest Sci. 26: 1-9, illus. 1952.

Figure 1.--Maunt Walker plat 10, first thinned maderately (31 percent basal area) in 1937. Phata was taken in 1949, during a second thinning. Grass cubic valume increment after 30 years was 91 percent af that in an unthinned area visible in right backgraund.

Figure 2.-- Maunt Walker plat 7 as it appeared after heavy thinning (50 percent basal area) in 1934; shaws apen canditian af residual stand. Grass 30-year increment in cubic valume was 75 percent af that in unthinned stand, with greatest grawth lass accurring during first 5 years after thinning.

Gross increment on both moderately thinned stands was within 9 percent of the unthinned stands in terms of cubic volume and practically identical in terms of Scribner board feet. The heavily thinned plots fell 25 percent below in cubic volume growth, or 20 percent in Scribner scale (table 1). Net increment was generally highest on moderately thinned plots, lower on unthinned plots, and lowest on heavily thinned plots.

Mortality was plainly lower on all thinned areas, averaging less than one-half that on unthinned plots. Further, roughly one-half of all mortality on thinned stands was, or could be, salvaged. Unsalvaged losses averaged 8 cubic feet, or 19 board feet Scribner, per acre per year for all thinned areas. Irrevocably lost were 38 cubic feet, or 47 board feet, on unthinned areas. Still, losses cannot be considered serious in either case.

Growth percent rates show greater efficiency of growing stock among all thinned stands. Average annual gross rates were 2.2 percent for cubic volume, or 3.2 percent for board feet, after thinning, but only 1.8 and 3.1 percent, respectively, in unthinned stands. The better rates for the thinned stands are, of course, directly related to reduced tree numbers.

Average stand diameter growth was 23 percent greater on thinned areas (3.48 inches versus 2.65 inches). There was an actual increase in growth, although part of the difference is the effect of eliminating most suppressed trees in initial thinning.

Restricting plot computations to only the 100 largest trees per acre confirms the greater efficiency of both volume and gross increment on thinned as opposed to unthinned stands:

	Percent of stand represented by the 100 largest trees		
	Unthinned plots 5 and 8	Lightly thinned plots 9 and 10	Heavily thinned plots 6 and 7
1964 stand:			
Basal area	59	75	97
Cubic volume	63	78	98
Board-foot volume (International)	68	81	99
Board-foot volume (Scribner)	83	89	100
Gross increment (1934-64):			
Basal area	58	61	83
Cubic volume	59	68	85
Board-foot volume (International)	64	72	84
Board-foot volume (Scribner)	69	71	88

Table 1.--Thirty-year increment and mortality record, Mount Walker thinning plots (1934-64)[1/]

Plot number	Item	Site index, 1964	Basal area cut	Stems	Basal area	Volume[2/]		
						Cubic	International	Scribner
		Feet	Percent	Number	Sq. ft.	Cu. ft.	Bd. ft.	
5 (unthinned)	Beginning stand	111	0	365	205.3	6,903	38,690	16,668
	Gross increment	--	--	--	102.6	4,595	33,379	24,760
	Mortality	--	--	105	29.8	883	4,136	1,348
	Net increment	--	--	--	72.8	3,712	29,243	23,412
6 (heavily thinned)	Stand after first thinning	114	44	144	116.9	4,337	27,184	13,321
	Gross increment	--	--	--	81.2	3,425	26,646	19,499
	Mortality	--	--	29	17.8	652	6,780	1,942
	Net increment	--	--	--	63.4	2,773	19,866	17,557
	Thinnings, 1949 and 1958	--	--	21	20.3	801	5,111	2,934
	Salvaged mortality[3/]	--	--	3	5.3	210	1,402	951
7 (heavily thinned)	Stand after first thinning	113	50	126	86.4	3,025	18,190	9,632
	Gross increment	--	--	--	78.6	3,416	24,092	17,552
	Mortality	--	--	14	4.3	143	760	400
	Net increment	--	--	--	74.3	3,273	23,332	17,152
8 (unthinned)	Beginning stand	103	0	678	216.3	6,615	32,463	10,773
	Gross increment	--	--	--	103.6	4,548	30,480	21,388
	Mortality	--	--	332	52.0	1,420	4,680	1,471
	Net increment	--	--	--	51.6	3,128	25,800	19,917
9 (moderately thinned)	Stand after first thinning	101	37	312	114.6	4,608	24,650	7,581
	Gross increment	--	--	--	102.9	4,164	29,491	22,490
	Mortality	--	--	38	18.5	636	3,763	2,298
	Net increment	--	--	--	84.4	3,528	25,728	20,192
	Thinnings, 1949 and 1958	--	--	58	28.7	968	5,354	934
	Salvaged mortality	--	--	2	1.8	71	459	286
	Salvable mortality, 1964[4/]	--	--	6	9.1	352	2,342	1,568
10 (moderately thinned)	Stand after thinning	111	31	217	157.8	5,764	35,343	17,295
	Gross increment	--	--	--	99.5	4,202	29,105	23,515
	Mortality	--	--	14	11.4	400	2,491	1,517
	Net increment	--	--	--	88.1	3,802	26,614	21,998
	Thinnings, 1949 and 1958	--	--	47	27.9	979	5,056	1,435
	Salvable mortality, 1964	--	--	3	7.2	278	1,900	1,315

1/ Plots 9 and 10, thinned in 1937, are adjusted to a 30-year basis.

2/ Cubic volume is for entire stem, International rule for trees 6.6 inches d.b.h. and larger to a 5-inch top, and Scribner rule for trees 11.6 inches d.b.h. and larger to an 8-inch top.

3/ Salvaged mortality is included in both "mortality" and "thinnings."

4/ Dead trees included in "mortality" which would have been salvaged had another thinning been made.

With wider spacing, the increases in d.b.h. increment most strikingly illustrate the effects of thinning (fig. 3). A significant rise is evident, beginning with a very close similarity in rates for both unthinned plots, to the greatest increase for plot 7, which was thinned to the fewest trees and smallest average diameter. No significance should be attached to the differences in slope of individual plot lines, except possibly for plot 9 where most of the 100 largest trees were concentrated toward the small end of the diameter range.

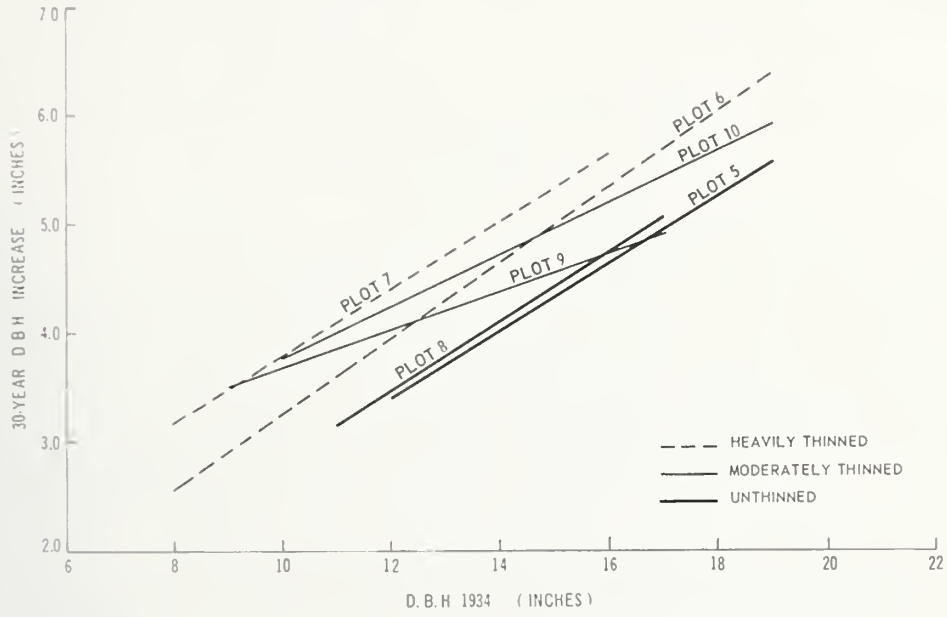

Figure 3.-- D. b. h. increase, 100 largest trees. Mount Walker thinning plots, 1934-64.

It can be reasonably inferred that the moderate thinnings on plots 9 and 10 were better suited to the low-site condition than were the heavier cuttings on plots 6 and 7. Moderate thinnings also compared much more favorably with unthinned stands in gross yield. Gross cubic-foot increment after moderate thinning, though only 82 percent of the unthinned standard during the first 15 years, was 103 percent in the last 15 years, whereas increment after heavy thinning improved from 66 percent to within 82 percent during the latter period. Such recovery reaffirms the tardy response elsewhere noted among older, young-growth stands.2/

2/ Worthington, Norman P., and Staebler, George R. Commercial thinning of Douglas-fir in the Pacific Northwest. U.S. Dep. Agr. Tech. Bull. 1230, 124 pp., illus. 1961. (See pp. 25-26.)